

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Student Exploration: Surface and Lateral Areas of Prisms and Cylinders

**Vocabulary:** cylinder, height (of a cylinder or prism), lateral area, net, prism, surface area

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)



1. Dustin is wrapping a present shaped like the one shown to the right. He has to find out how much wrapping paper he needs to cover all sides of the box.

- A. Four sides are rectangles. Each rectangle has length 7 in. and width 4 in. Find the total area of these sides.

Area of one rectangle = \_\_\_\_\_ Total area = \_\_\_\_\_

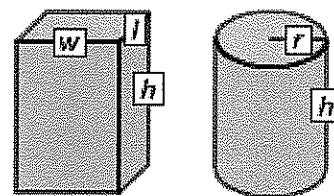
- B. The top and bottom of the box are squares with sides of 4 in. Find the total area of the top and bottom.

Area of one square = \_\_\_\_\_ Total area = \_\_\_\_\_

2. How many square inches of wrapping paper does Dustin need? \_\_\_\_\_

### Gizmo Warm-up

Dustin's present is a **prism**. A prism is a 3-dimensional figure with two parallel, congruent polygonal bases and sides that are parallelograms. Prisms with one base directly above the other are **right prisms**. A **cylinder** is similar to a prism, but with circular bases. You will explore the areas of right prisms and cylinders in the *Surface and Lateral Areas of Prisms and Cylinders Gizmo™*.



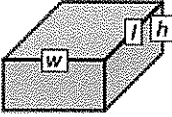
1. In the Gizmo, be sure **Rectangle** is selected. Drag the point at the top right corner of the rectangle down to change **l** (length of base), and to the left to change **w** (width of base). How does the **3-D View** and the **Unfolded View (net)** of the prism change in each case?

Length: \_\_\_\_\_

Width: \_\_\_\_\_

2. Drag the **Height (h)** slider to change the **height**. How do the figures change? \_\_\_\_\_

\_\_\_\_\_

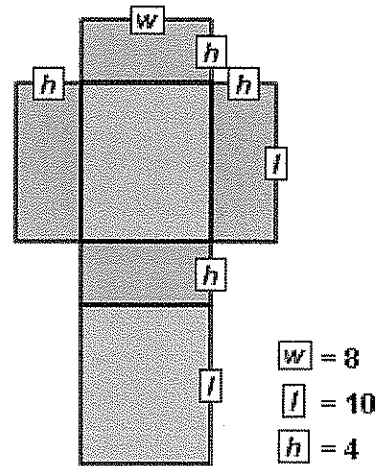
<b>Activity A:</b> <b>Rectangular prisms</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>• Be sure <b>Rectangle</b> is selected.</li> <li>• Set the <b>Width (w)</b> to 8 and the <b>Length (l)</b> to 10.</li> <li>• Set the <b>Height (h)</b> to 4.0 units by dragging the slider or entering a value to the right of the slider.</li> </ul>	
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1. The **surface area** of a prism can be found by adding the areas of all faces of the prism. Use the net view to find the area of each face of a right rectangular prism with width 8, length 10, and height 4.

- A. First, find the area of each face. Write each area on the net to the right.
- B. Then add the areas of all faces to find the surface area (S.A.) of the rectangular prism.

S.A. = \_\_\_\_\_

Select **Compute lateral area** and **Compute surface area** to check your answer.



2. Turn off **Compute surface area**. Notice that some rectangles are still shaded. These are the lateral faces, or sides, of the rectangular prism.

- A. Add the areas of the lateral faces to find the **lateral area (L.A.)**. L.A. = \_\_\_\_\_

Compare your answer to the **Lateral area** value given in the Gizmo.

- B. Turn off **Compute lateral area**. Because all of the lateral faces have the same height, they can be combined together into a single rectangle, as shown below.



What is the length of this rectangle, in terms of  $l$  and  $w$ ? \_\_\_\_\_

- C. What is the perimeter of the base of the prism (using  $l$  and  $w$ )?  $P$  = \_\_\_\_\_

- D. How is the perimeter of the base related to the length of the lateral area rectangle?

\_\_\_\_\_

- E. How can you find the lateral area using the perimeter of the base and the height?

\_\_\_\_\_

(Activity A continued on next page)

**Activity A (continued from previous page)**

3. Turn on **Compute lateral area**.

- A. How is lateral area computed in the Gizmo? \_\_\_\_\_
- B. Find the lateral area of a right rectangular prism with  $w = 3$ ,  $l = 4$ , and  $h = 7$ . Show your work to the right and check in the Gizmo.

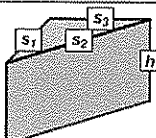
4. Turn on **Compute surface area**. Look at the surface area formula ( $S.A. = L.A. + 2 \cdot B$ ).

- A. Why can you add twice the base area to the lateral area to find the surface area?  
\_\_\_\_\_
- B. Now use just  $w$  (width),  $l$  (length), and  $h$  (height) to write another formula for the surface area of a right rectangular prism.  $S.A. =$  \_\_\_\_\_
- C. What part of the formula you wrote above is the same as the  $L.A.$  part of the formula given in the Gizmo? \_\_\_\_\_
- D. What part of the formula you wrote is the same as the  $2 \cdot B$  part of the formula given in the Gizmo? \_\_\_\_\_

5. A right rectangular prism has a square base with side lengths 4.5 in. and a height of 7 in. Find the lateral and surface areas of this prism. Show your work, and check in the Gizmo.

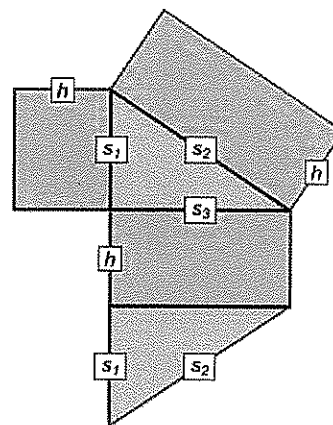
6. Jessie is painting a 5-ft by 6-ft guest bathroom. The ceiling of the bathroom is 8 ft high.

- A. Find the total square footage of the four walls. Show your work.
- B. What is the surface area of the whole bathroom? Show your work.

<b>Activity B:</b> <b>Triangular prisms</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>• Turn off <b>Compute lateral area</b>.</li> <li>• Select <b>Triangle</b>.</li> </ul>	
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1. Drag the points at the vertices of the triangle to create a right triangle with  $s_1 = 10$  and  $s_3 = 15$ , as shown to the right. The length of  $s_2$  should be 18.03. Set the **Height ( $h$ )** to 8.0.

- Find the area of each rectangular (lateral) face of this right triangular prism. Write these areas on the net.
- The area of each right triangular base with legs  $s_1$  and  $s_3$  is  $A = 0.5 \cdot s_1 \cdot s_3$ . Calculate the area of the base, and write the base areas on the net. Check your work in the Gizmo. (The base area is given under the triangle.)
- What is the surface area (S.A.) of the triangular prism?



S.A. = \_\_\_\_\_

Turn on **Compute lateral area** and **Compute surface area** to check.

2. Turn off **Compute surface area**.

- Add the areas of the three lateral faces. What is the lateral area (L.A.) of the prism?

L.A. = \_\_\_\_\_ Check your work in the Gizmo.

- What is the perimeter of the base? \_\_\_\_\_

- How can you use the perimeter of the base and the height to find the lateral area?

\_\_\_\_\_ Use the Gizmo to check that this is true.

- Multiply the perimeter of the base times the height. Is this area the same as the

lateral area you found above? \_\_\_\_\_ Turn on **Compute lateral area** to check.

3. In the Gizmo, create a triangular prism of your own with a height of 6.0. List the three side lengths of the base below. In the space to the right, find the lateral area of your prism. Check your work in the Gizmo.

$s_1 =$  \_\_\_\_\_  $s_2 =$  \_\_\_\_\_  $s_3 =$  \_\_\_\_\_

(Activity B continued on next page)

**Activity B (continued from previous page)**

4. Look back at question 1.

A. How can you use the lateral area and the area of the base to find the surface area?

\_\_\_\_\_

B. Write two different formulas for finding the surface area of a right triangular prism. In the first, use lateral area ( $L.A.$ ) and area of the base ( $B$ ). In the second, use the perimeter of the base ( $P$ ), height ( $h$ ), and area of the base ( $B$ ).

S.A. = \_\_\_\_\_ S.A. = \_\_\_\_\_

Turn on **Compute surface area** to check your formulas.

C. Write another formula for finding the surface area of a right triangular prism with a base that is a right triangle. Use  $s_1$  and  $s_3$  for the legs of the base and  $h$  for the height of the prism.

S.A. = \_\_\_\_\_

5. Turn off **Compute lateral area**. Create a triangular prism of your own.

A. List the dimensions of your prism.

$s_1$  = \_\_\_\_\_  $s_2$  = \_\_\_\_\_  $s_3$  = \_\_\_\_\_  $h$  = \_\_\_\_\_

B. Use both of the formulas you wrote in part B above to find the surface area of your prism. (The base area is given in the Gizmo.) Show your work. Then turn on **Compute lateral area** and **Compute surface area** to check your work.

6. A right triangular prism has a right triangular base with legs 3 ft and 4 ft, and hypotenuse 5 ft. If the height is 12 ft, find the surface area. Show your work.